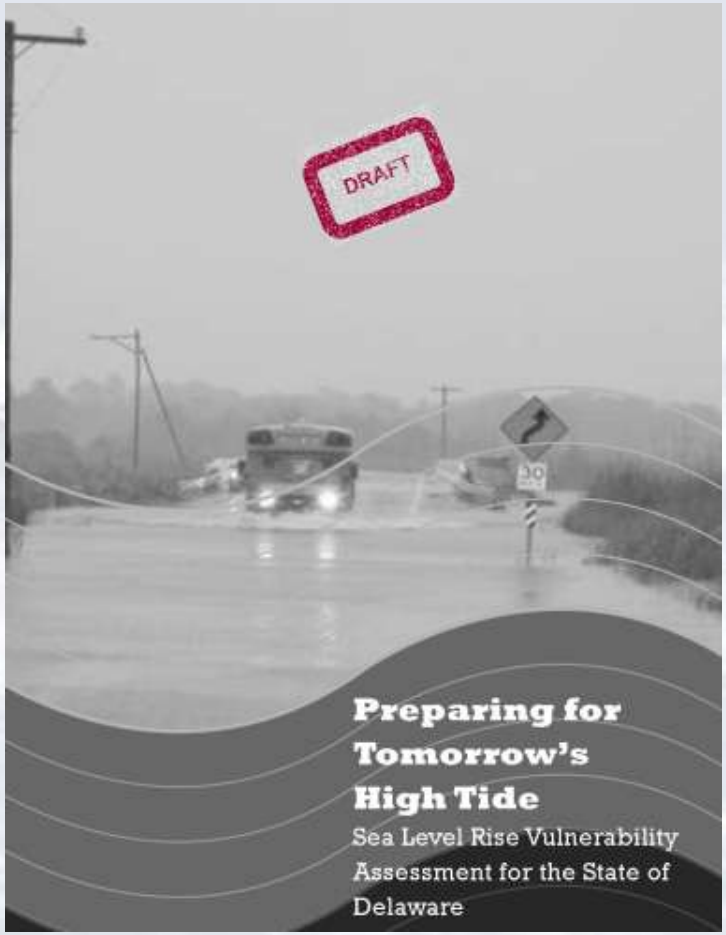
Results of Delaware's Sea Level Rise Vulnerability Assessment

Presentation for the Delaware Sea Level Rise Advisory Committee
April 5, 2012



Draft Document Overview

- Exec Summary
- Intro
- Methods
- Results
- Society & Econ
- Natural Resources
- Public Safety & Infrastructure
- Public Engagement
- Next Steps

- Appendixes
  - ✓ Members
  - ✓ Acronyms
  - ✓ Glossary of Terms
  - ✓ Mapping Appendix

*pictures to be added

Risk Assessment Exercise

Score	Impact		Geographic Scope	Recommended Action
High Concern	Resource does not function or meet its intended use	And/or	Statewide	Develop adaptation strategies
Moderate Concern	Major loss of function or some failure of intended use	And/or	County-level	Evaluate further and develop adaptation strategies if necessary
Low Concern	Resource functions with modifications	And/or	Localized	Monitor and re-asses in future years
Minimal Concern	minor or no impact to function	And/or	Isolated	Re-asses in future years

Society & Economy Findings

Society & Economy Workgroup Members

Name	Organization Represented
David Ames	UD Center for Historic Architecture and Design
Rich Collins	Positive Growth Alliance
Mark Davis	Delaware Department of Agriculture
Barbara DeHaven	Delaware Economic Development Office
Andrea Godfrey	Delaware Office of Management and Budget
Mary Ellen Gray	Kent County Department of Planning
Alice Guerrant	Delaware Division of Historic and Cultural Affairs
Connie Holland	Delaware Office of State Planning Coordination
Quinn Johnson	Delaware House of Representatives
Karl Kalbacher	New Castle County
Sarah Keifer	Kent County Department of Planning
Michael Kirkpatrick	Delaware Department of Transportation
John Laznik	UD Center for Applied Demography and Survey Research
Bill Lucks	Delaware Realtor's Association
Rob McCleary	Delaware Department of Transportation
Richard Perkins	Delaware Department of Health and Social Services
Mike Powell	DNREC Division of Watershed Stewardship
Keith Rudy	Home Builder's Association of Delaware
John Taylor	Delaware State Chamber of Commerce
Greg Williams	DNREC Division of Watershed Stewardship

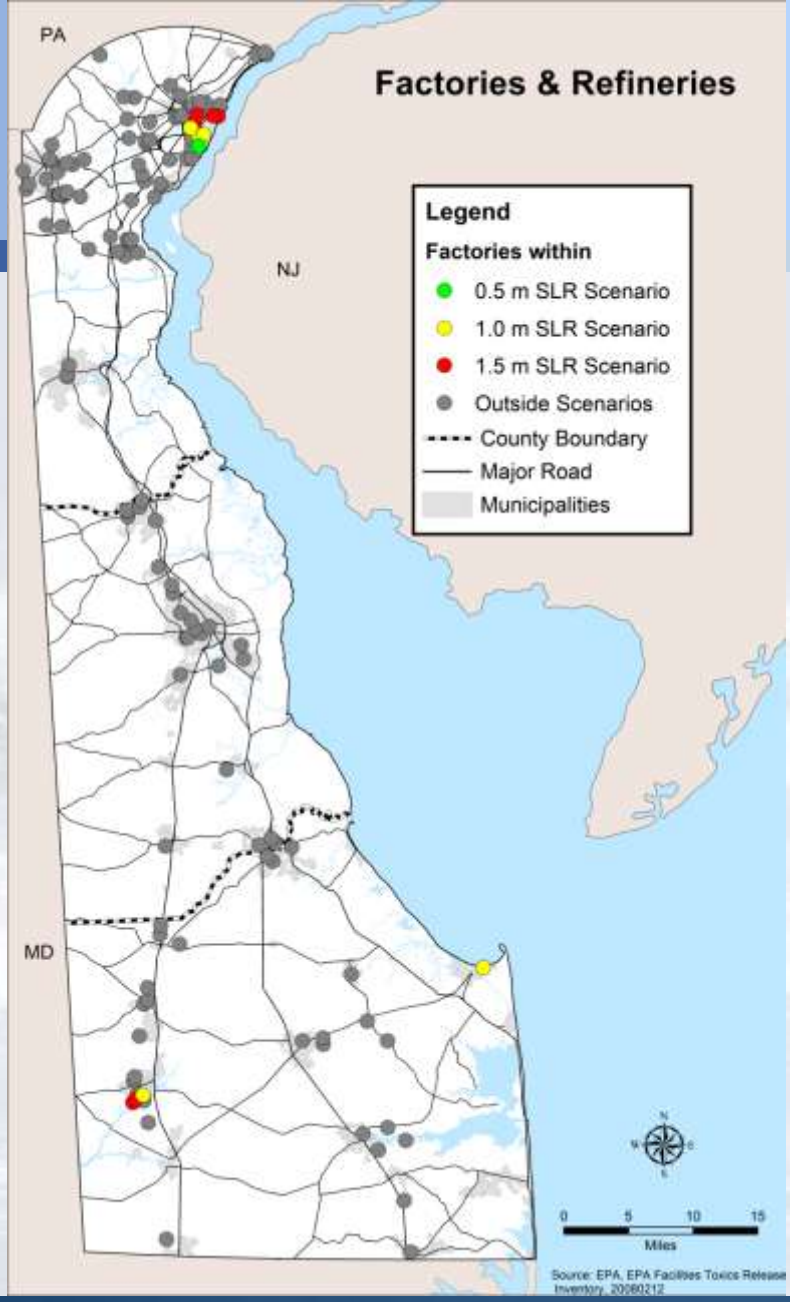
Society & Economy

High Concern	Moderate Concern	Low Concern
Heavy Industrial Areas	Residences	Businesses & Commercial Areas
Future Development Areas		Agriculture (production)
Tourism & Coastal Recreation		Industrial & Manufacturing facilities
		Historic Resources

** Social vulnerability not ranked but recognized as consideration in all of above*

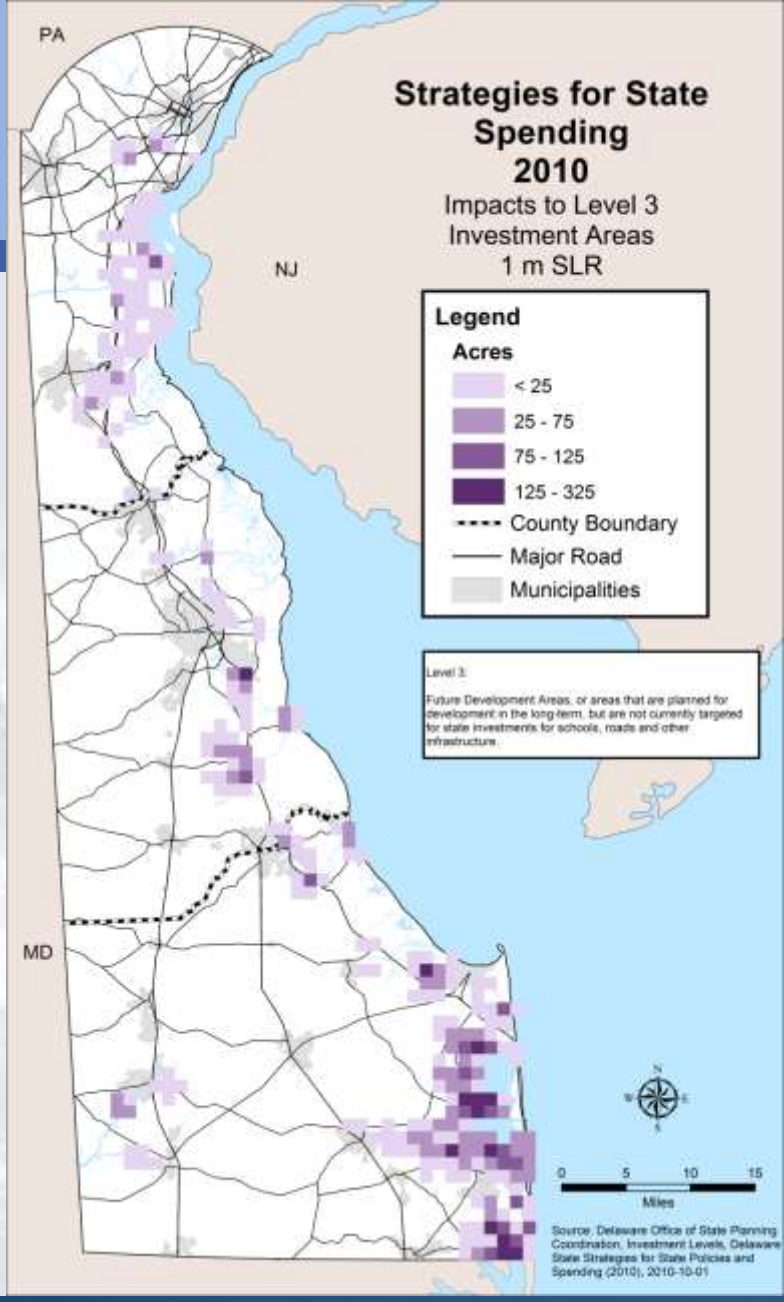
Industrial Areas (high)

- 16%-25% land permitted by CZA potentially inundated
  - ✓ Primary NCCo
- Impacts
  - ✓ Inundation of associated structures
  - ✓ Limited ability to relocate within state
- Statewide economic impact



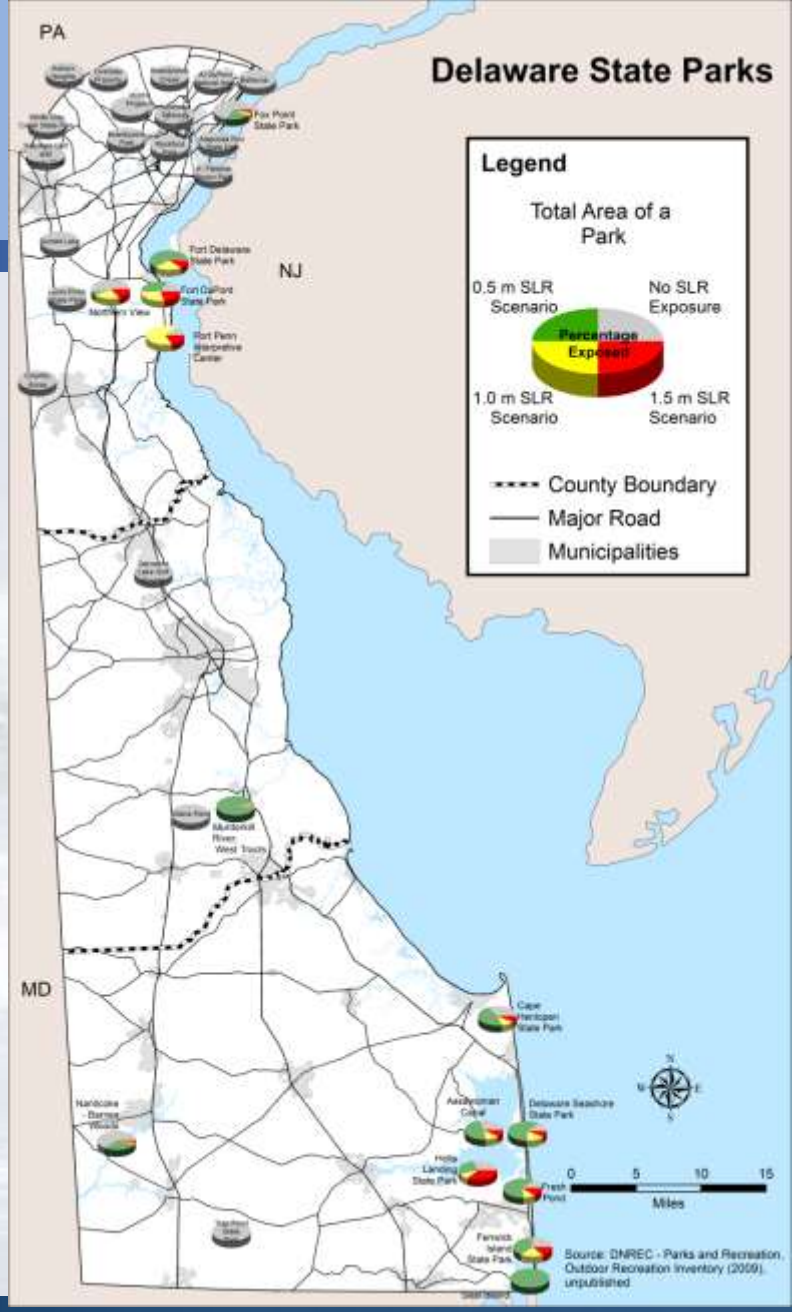
Future Development Areas (high)

- 3%-7% potentially inundated
  - ✓ 4/5 in Sussex County
- Impact
  - ✓ Reduced growth zones
  - ✓ Challenge to redirect growth without limiting choice
- Statewide potential impacts for state funding, legal concerns.



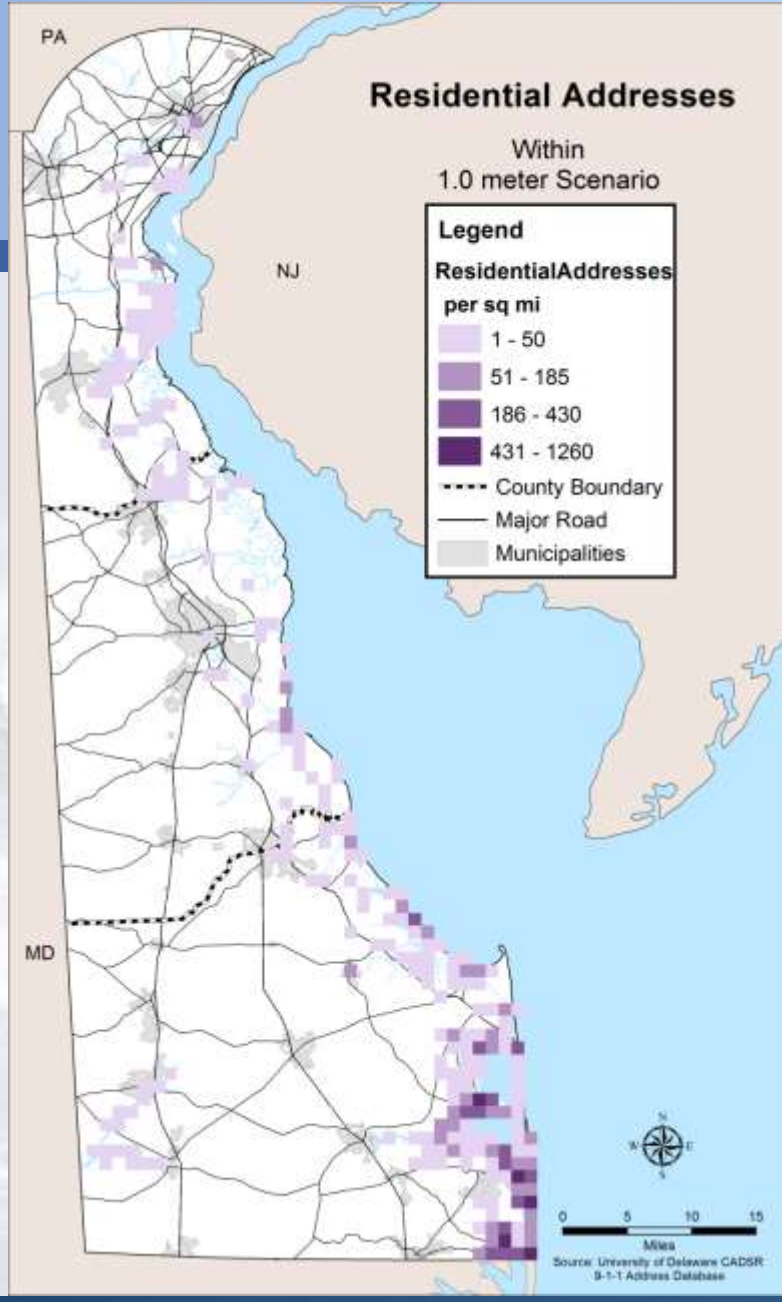
Tourism & Coastal Recreation (high)

- Lack of specific data
- High potential for loss of beach and ecotourism opps & revenues = statewide concern
- Additional studies/data necessary



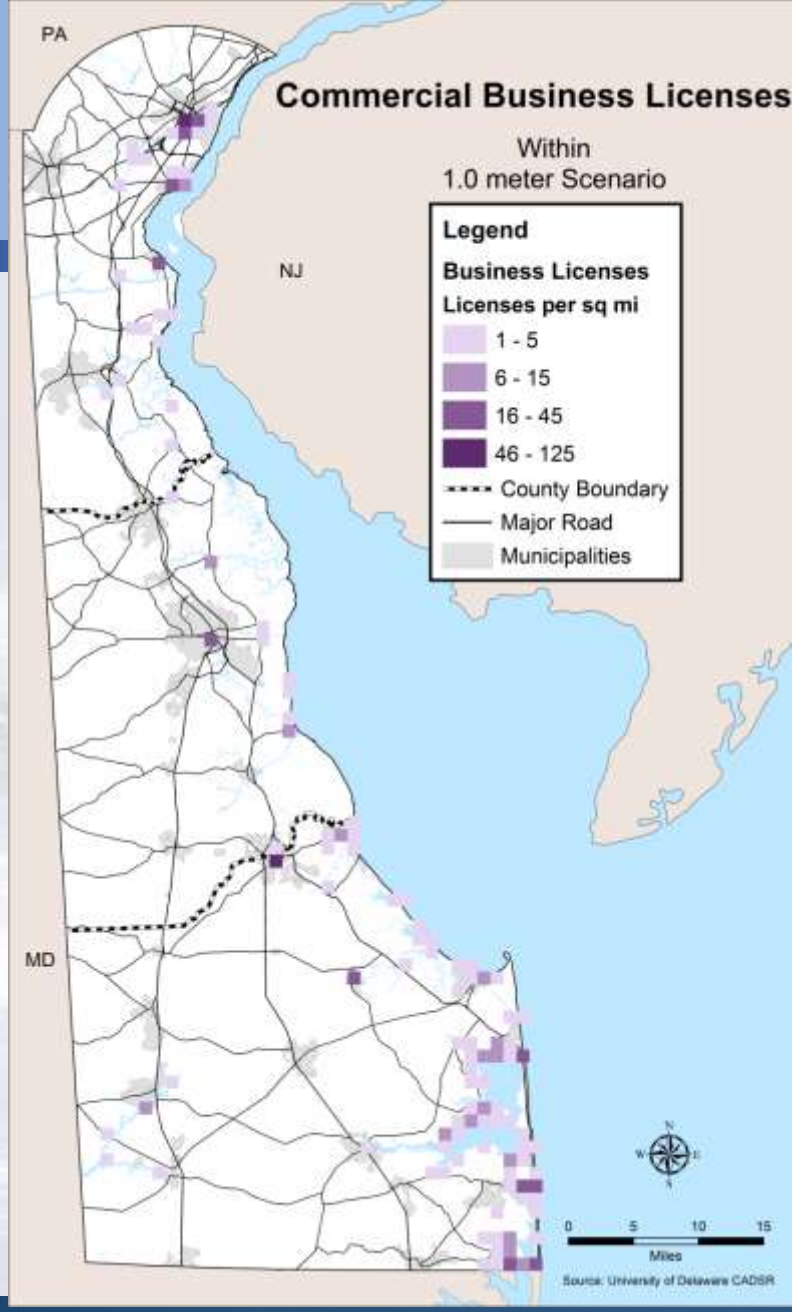
Residential (moderate)

- 1%-5% potentially inundated
  - ✓ Up to 32% manufactured homes in Sussex
- Impacts
  - ✓ Flood damage, insurance costs, access, community
- Varying ability to adapt
- Primarily County level impact



Businesses (low)

- 1%-5% commercial addresses
- Impacts
  - ✓ Flood damage, ins. Cost, reduced access
  - ✓ Particular impacts to commercial fishing
- Limited biz life-span; adequate commercial areas inland



Natural Resources Findings

Natural Resources Workgroup Members

Name	Organization Represented
Jennifer Adkins	Partnership for the Delaware Estuary
Chris Bason	Center for the Inland Bays
Karen Bennett	Delaware Department of Natural Resources and Environmental Control
Robert Coxe	Delaware Department of Natural Resources and Environmental Control
Sarah Cooksey	Delaware Department of Natural Resources and Environmental Control
Morgan Ellis	Delaware Department of Natural Resources and Environmental Control
Brenna Goggin	Delaware Nature Society
Susan Guiteras	U.S. Fish and Wildlife Service
Roger Jones	The Nature Conservancy
Kevin Kalasz	Delaware Department of Natural Resources and Environmental Control
Andy Manus	The Nature Conservancy
Chris Sommerfield	University of Delaware
Hillary Stevens	University of Delaware
Michael Stroeh	U.S. Fish and Wildlife Service
Pam Thornburg-Bakerian	Delaware Farm Bureau
Robin Tyler	Delaware Department of Natural Resources and Environmental Control

Natural Resources

High Concern	Moderate Concern	Low Concern
Tidal Wetlands	Nature Preserves	Non-tidal Wetlands
Freshwater Tidal Wetlands	Agricultural Land Conservation Easements	Highly Productive Soils
Coastal Impoundments		Agricultural Land Preservation Districts
Habitats of Conservation Concern		Upland Forest
Protected Lands Statewide		
USFWS Refuge Property		
Beaches and Dunes		

* Salinity Changes and Groundwater Effects evaluated but not ranked

Salinity Changes (not ranked)

- SLR scenarios indicate exposure not salinity

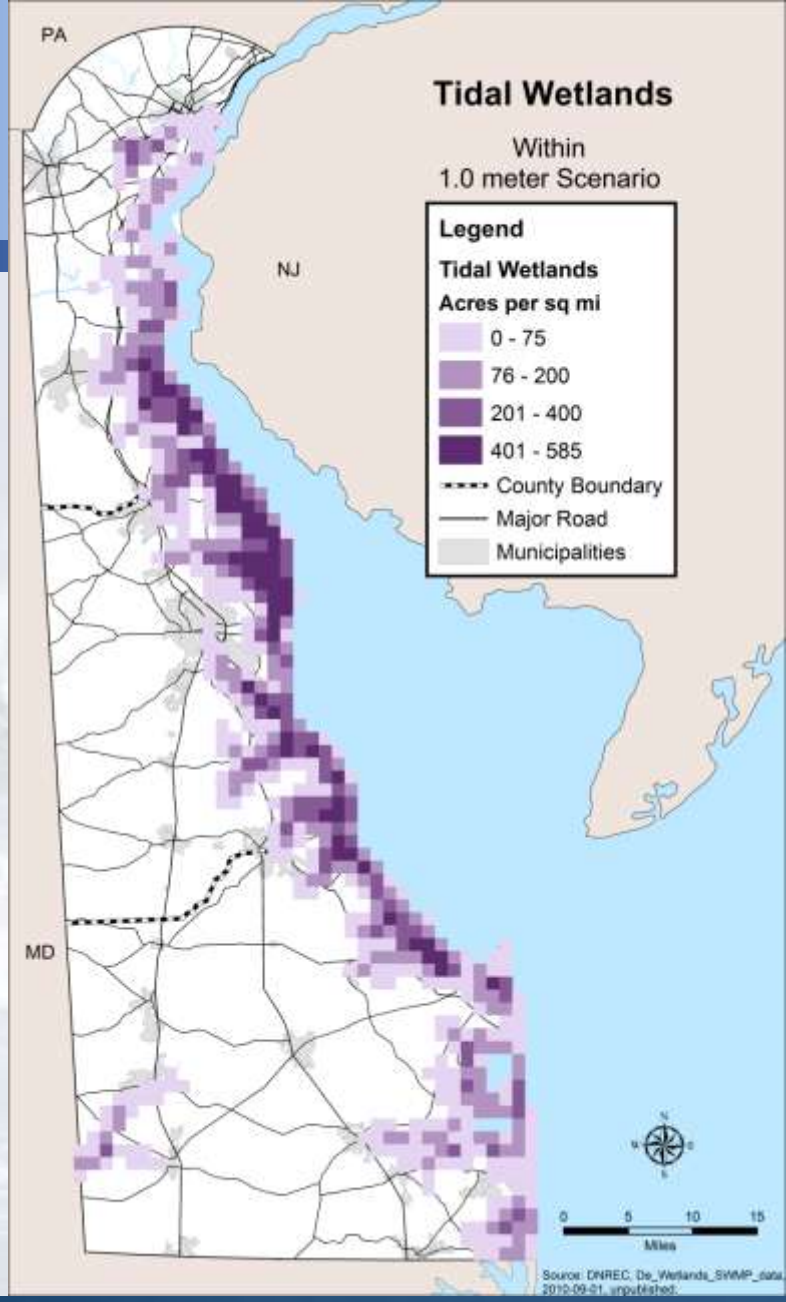
- Change in salinity difficult to predict:
  - ✓Related to changes in depth and shape of the estuary
  - ✓Extent of tidal influence
  - ✓Freshwater runoff
  - ✓Human influence on the estuary

Groundwater Effects (not ranked)

- SLR scenarios alone not adequate for groundwater assessment
  - ✓ Need to consider precipitation, runoff & recharge
  - ✓ Increased freshwater inputs may counterbalance landward movement of saltwater
- Undeveloped recharge areas
  - ✓ 2% to 4% acres statewide
- Wellhead protection areas
  - ✓ Public wells only
  - ✓ 1% to 3% of protection acres statewide
  - ✓ Largest impact in Sussex— 1%-6%

Tidal Wetlands (high)

- 97% to 99% potentially inundated
- Highly productive systems
  - ✓ Important habitat
  - ✓ Spawning and feeding grounds
  - ✓ Contaminant filter
- Absorb storm surges and flooding
- Recreational value
  - ✓ Birding, hunting, kayaking, etc.



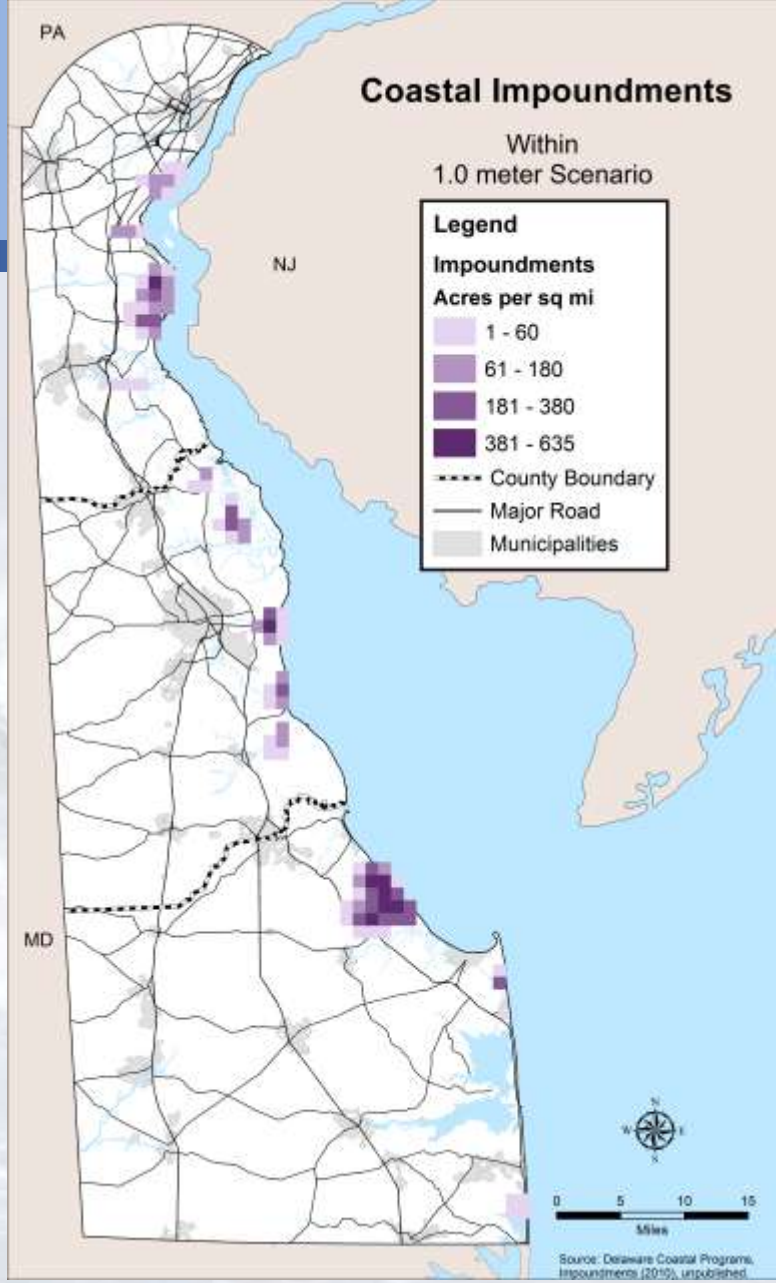
Freshwater Tidal Wetlands (high)

- 84% to 98% statewide
- Upper reaches of tidal influence
- Known for high species diversity
- Rising water and salinity a concern

Chris Bennett

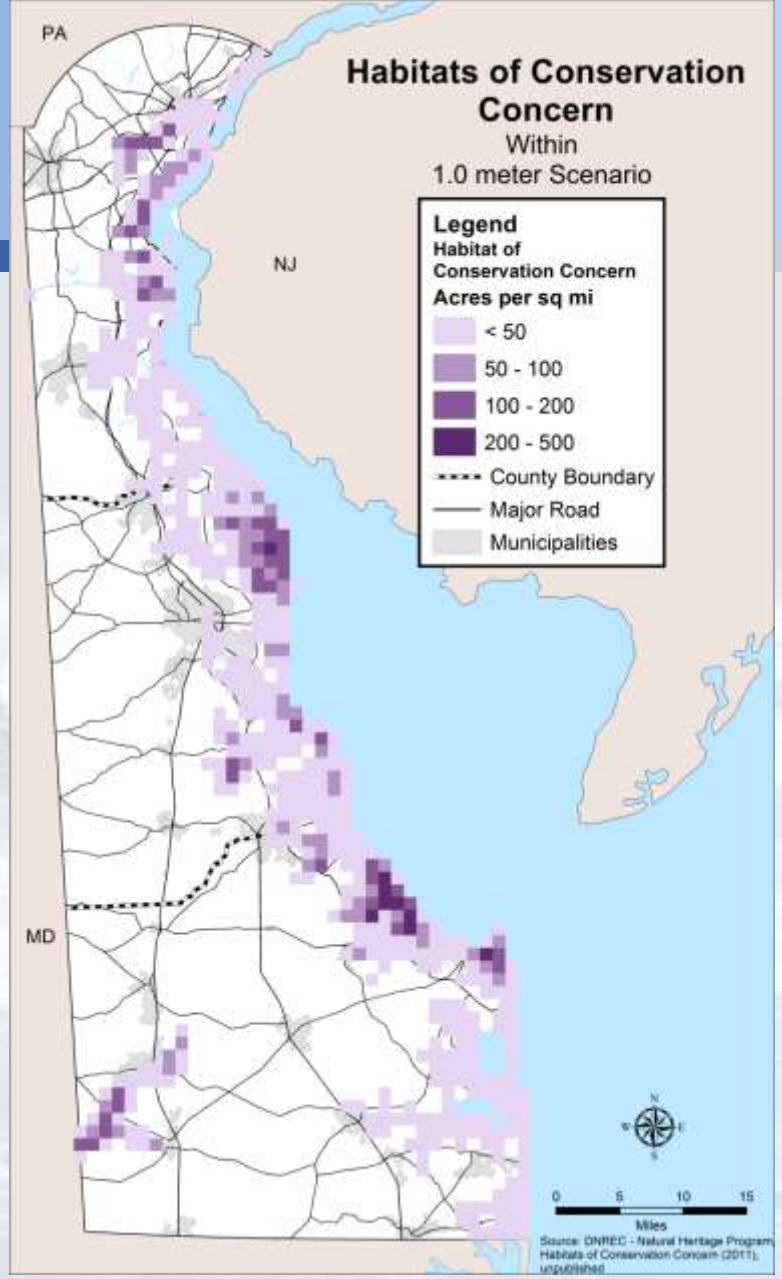
Coastal Impoundments (high)

- 81% to 99% potentially inundated
- Largest owners
  - ✓ USFWS
  - ✓ DE Fish and Wildlife
  - ✓ City of New Castle
- Provides important waterfowl & migratory bird habitat and flood control



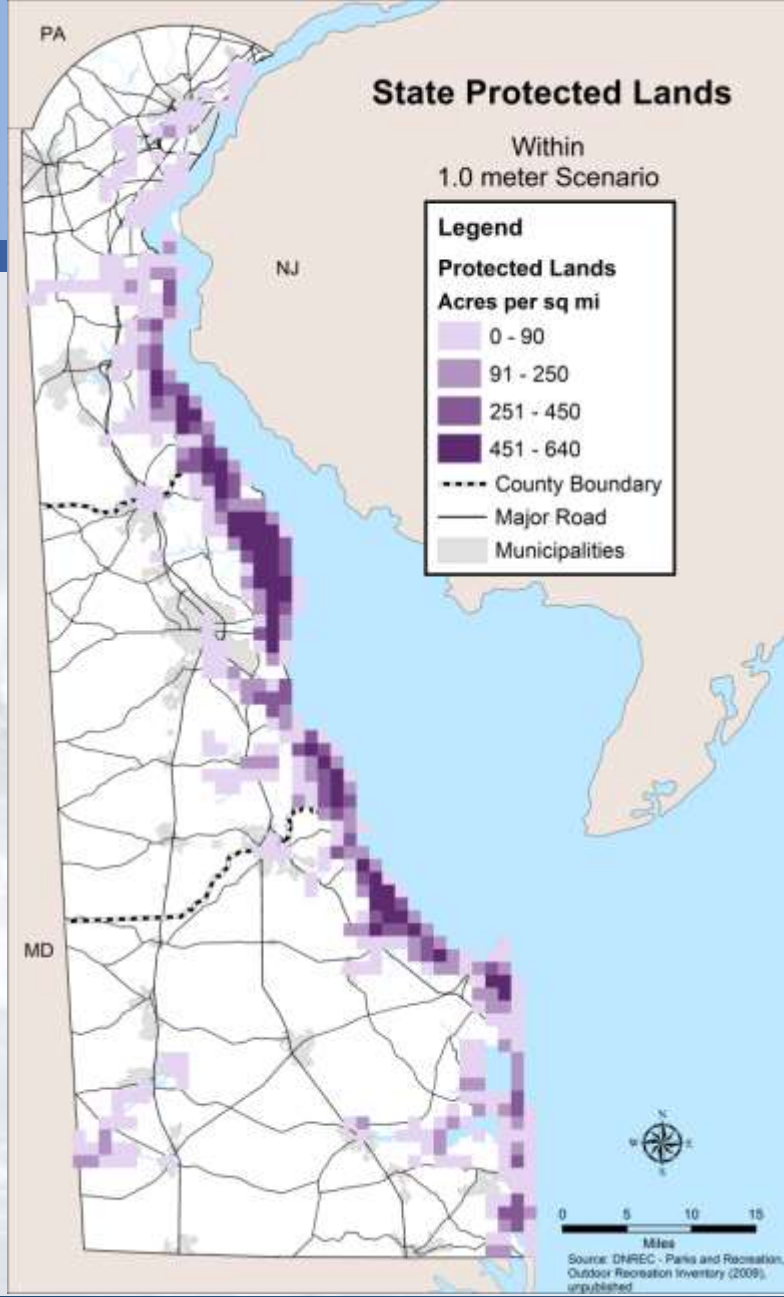
Habitats of Conservation Concern (high)

- 55% to 65% acres potentially inundated
- Unique habitat types identified in the DE Wildlife Action Plan
- High diversity, sensitive to disturbance, harbor rare species



Protected Lands Statewide (high)

- 37% to 44% potentially inundated
- Includes State owned lands, federal refuges, municipal holdings and public and private conservation easements
- Represent a variety of habitat types and outdoor recreation opportunities



U.S. Fish & Wildlife Refuges (high)

- 85% to 95% acres potentially inundated
- Only 2 locations…
  - ✓ Prime Hook NWR
  - ✓ Bombay Hook NWR
- But large acreage affected
  - ✓ 21,354 to 24,120 acres
  - ✓ Massive loss of protected habitat

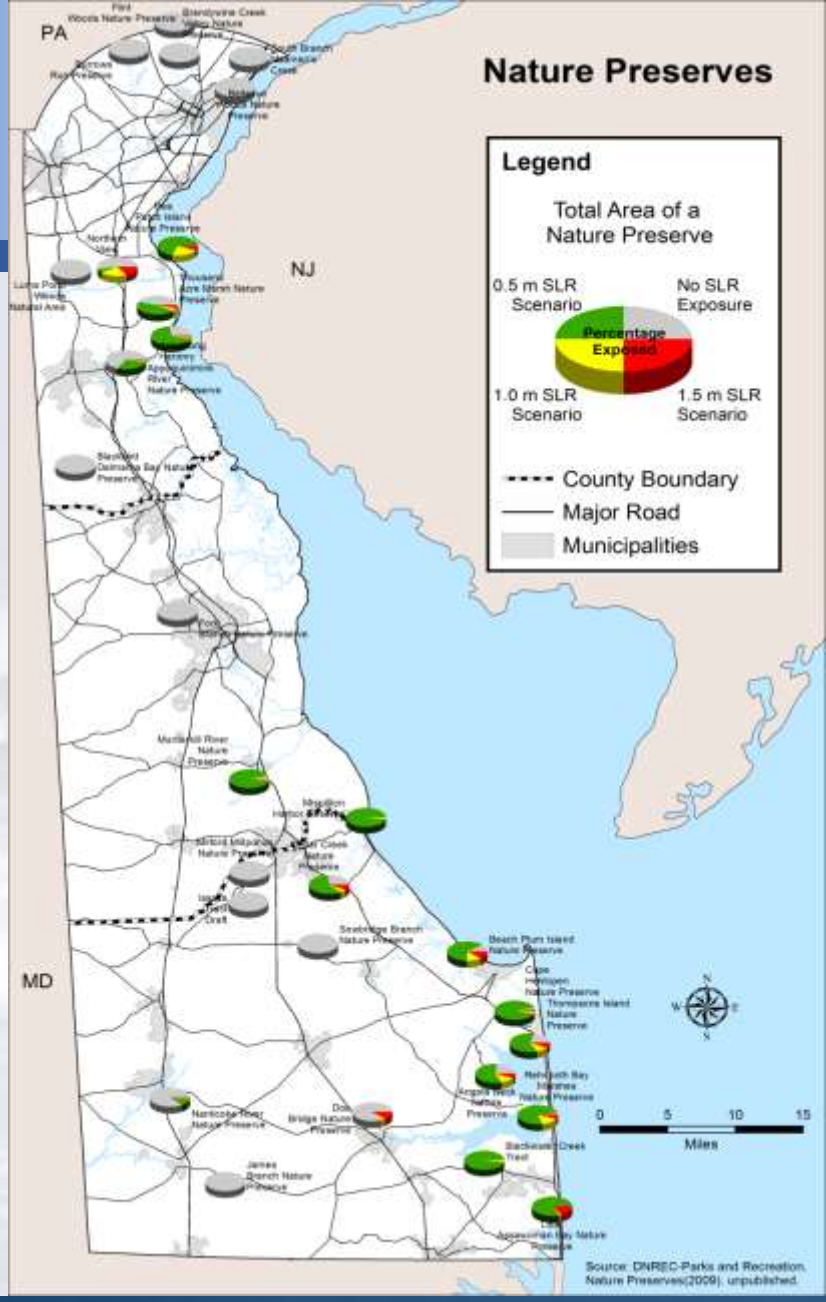
Chris Bennett

Beaches and Dunes (high)

- Extremely dynamic environment
  - ✓ No map or data tables
- Bay Beaches and Atlantic Coast
- High economic and natural resource value
- History of state investment in protection/sand replenishment

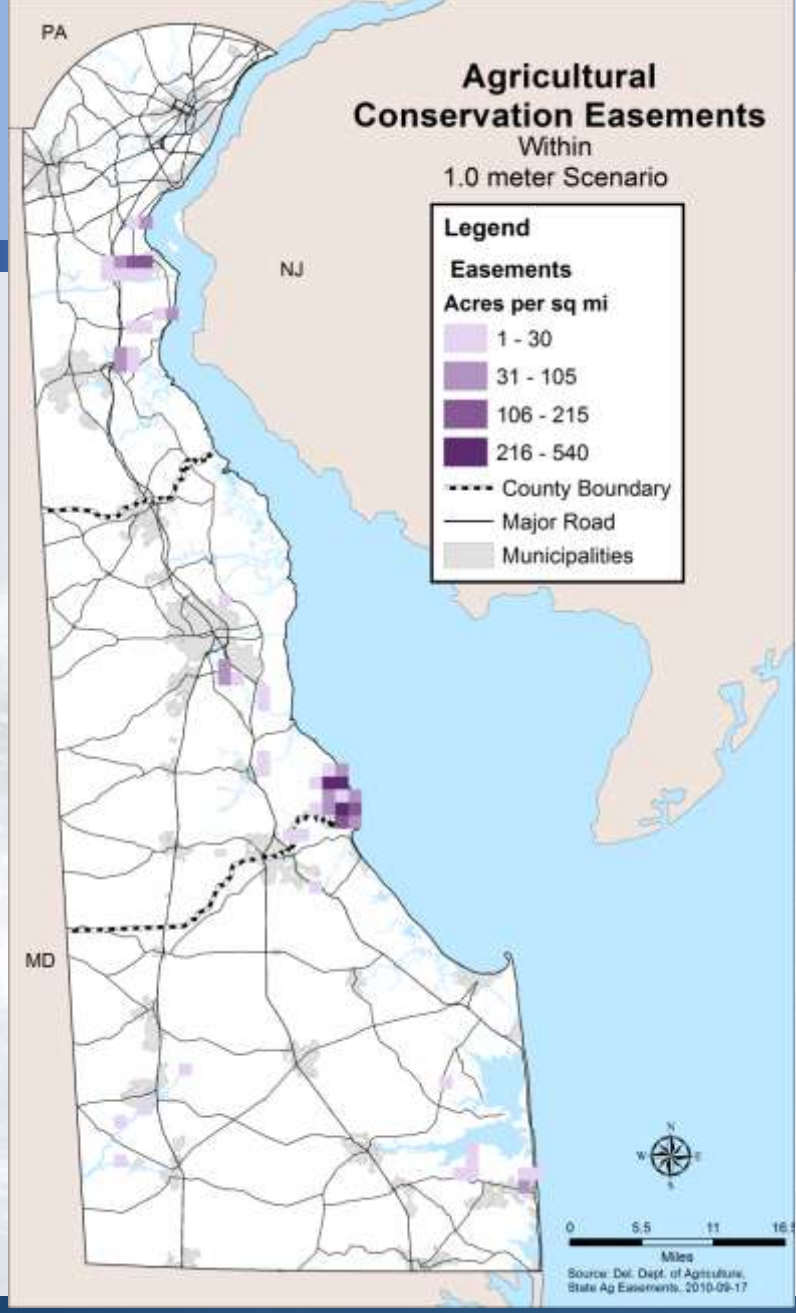
Nature Preserves (moderate)

- 34% to 43% potentially inundated
- 28 preserves, both public and private land and water
- Exceptional habitats
- Highest degree of protection within the state



Ag Land Conservation Easements (moderate)

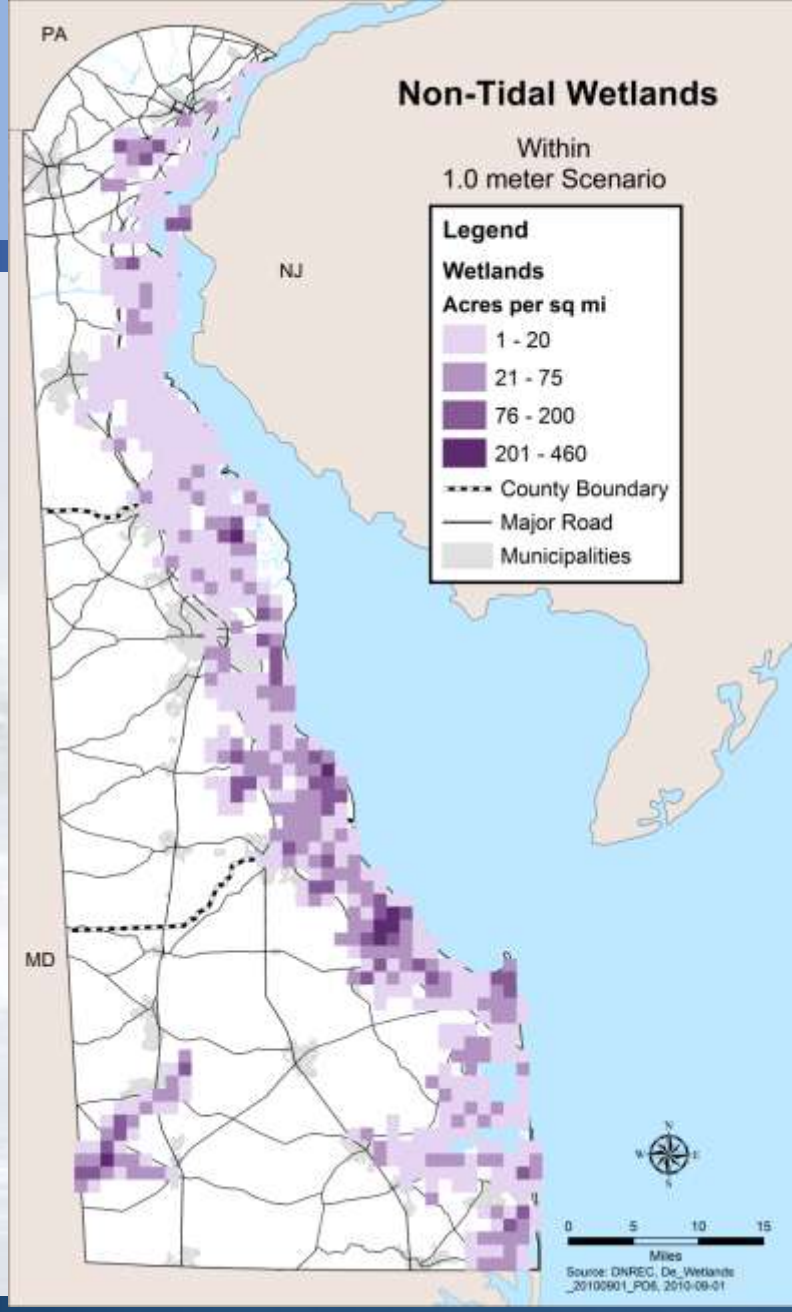
- 13% to 17% potentially inundated
- Permanently protected lands
- Important land use tool to preserve farming & open space



Non-tidal Wetlands (low)

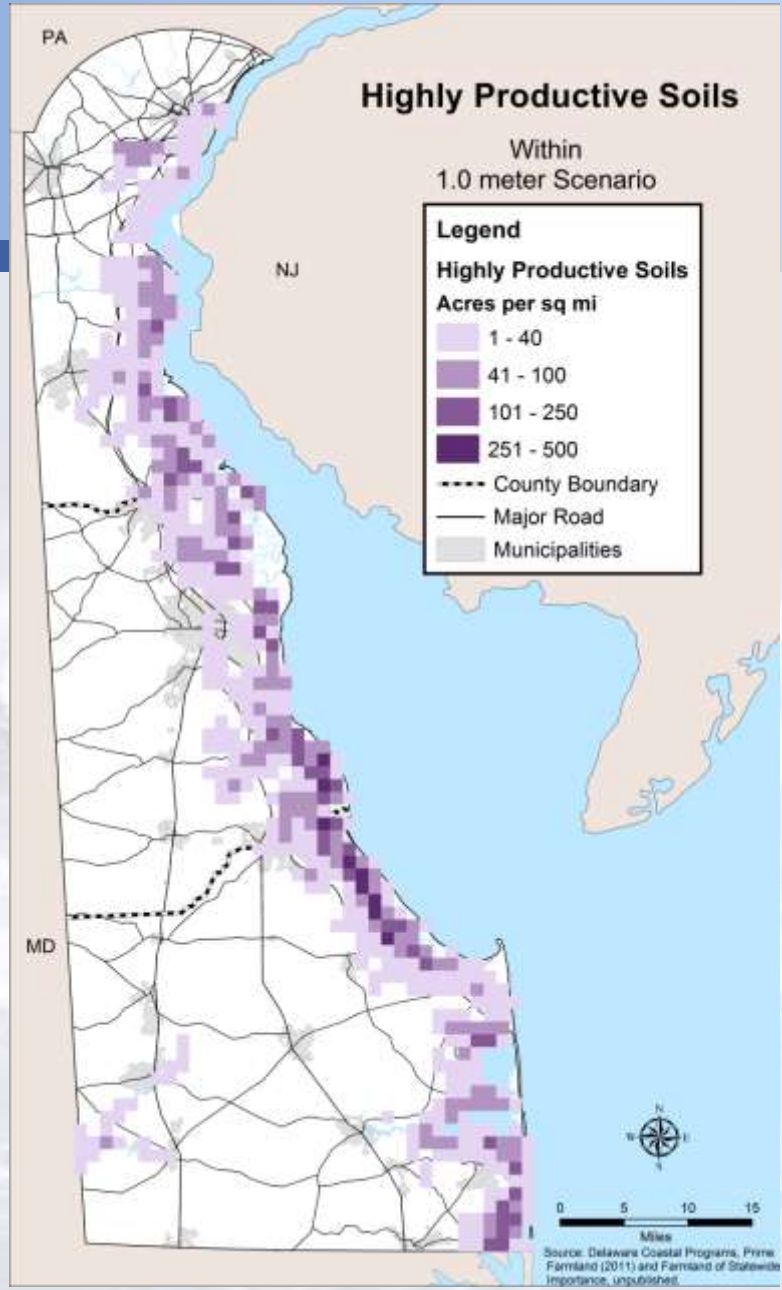
- 140,891 total acres statewide
- 6% to 9% potentially inundated

- Very important habitats
- Relatively limited acreage affected by SLR



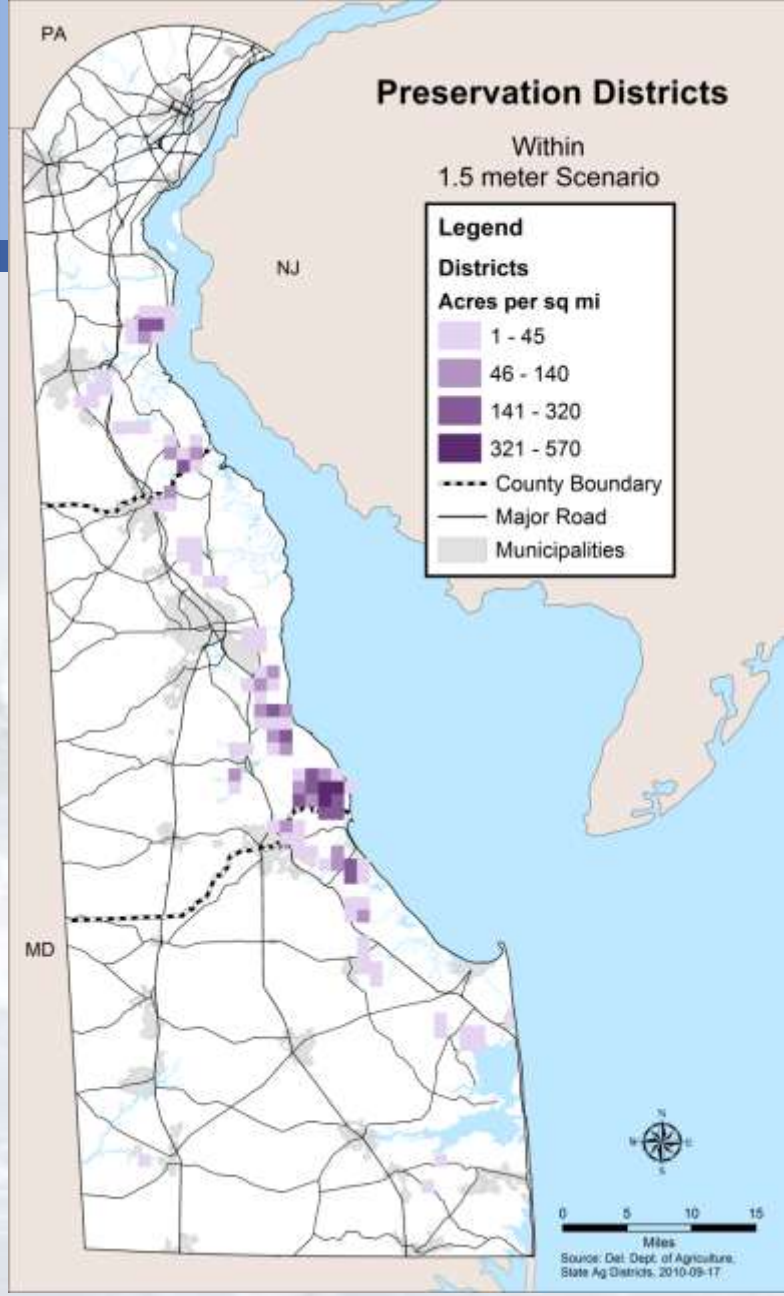
Highly Productive Soils (low)

- 2% to 4% potentially inundated
- Includes prime farmland and farmland of statewide importance
- Land where high crop yields are possible
- Land use not considered



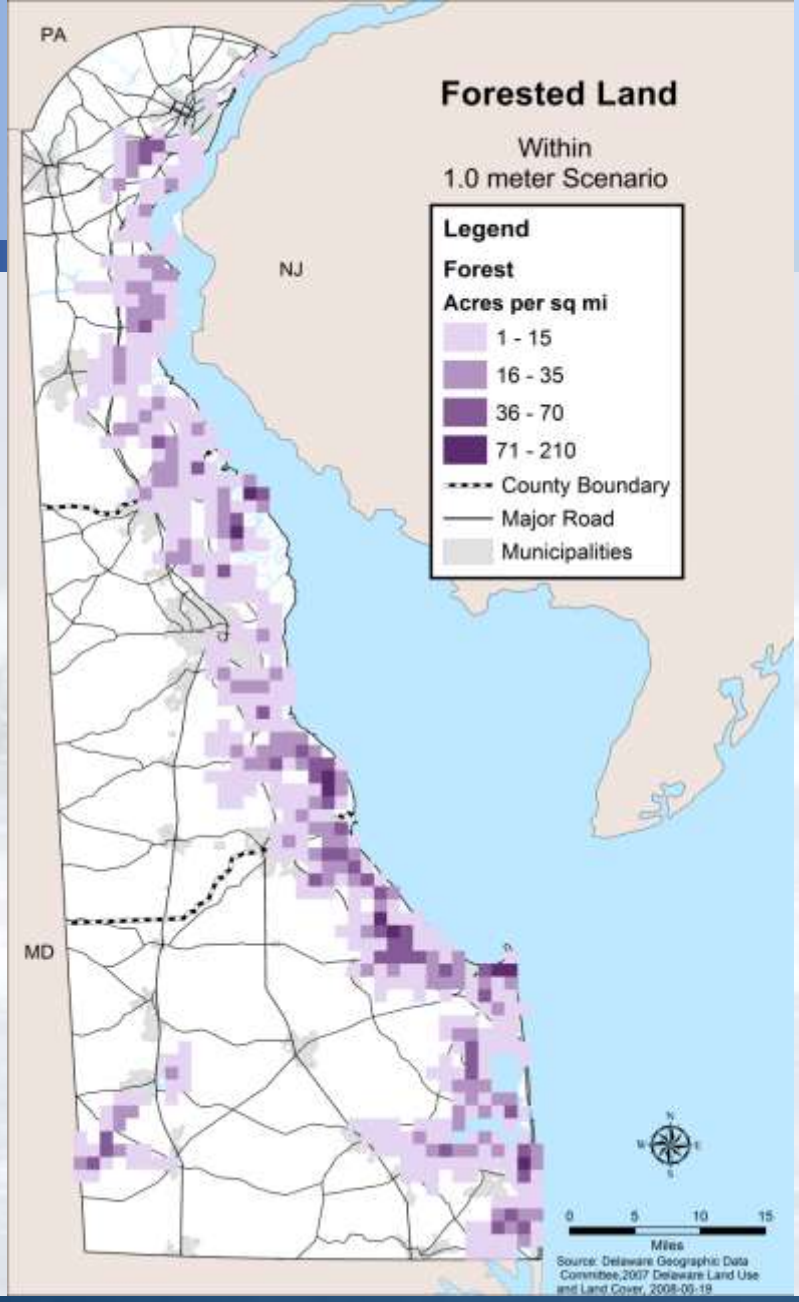
Ag Preservation Districts (low)

- 13% to 17% potentially inundated
- 94,401 total acres statewide
- Voluntary agreement to use land for Ag purposes for minimum of 10 years
- Impact does not affect the functionality of the program statewide



Upland Forest (low)

- 2% to 6% potentially inundated
- Negative effect on habitat & species diversity
- Relatively limited impact statewide



Public Safety & Infrastructure Findings

Public Safety & Infrastructure Workgroup Members

Name	Organization Represented
Dave Carlson	Delaware Emergency Management Agency
Greg DeCowsky	DNREC Div. of Waste & Hazardous Substances
Jerry Esposito	Tidewater Utilities
John Greer	Public
Karissa Hendershot	DNREC Div. of Waste & Hazardous Substances
Jim Kirkbride	Public
Michael Kirkpatrick	Delaware Department of Transportation
Don Knox	Delaware Emergency Management Agency
Nancy Lawson	Public
John Laznik	UD Center for Applied Demography & Survey Research
Victor Letonoff	City of Lewes Council
Robert McCleary	Delaware Department of Transportation
Cindy Miller	Public
Kurt Reuther	Delaware Department of Safety & Homeland Security
Peggy Schultz	League of Women Voters
Dr. Chad Tolman	League of Women Voters

Public Safety & Infrastructure

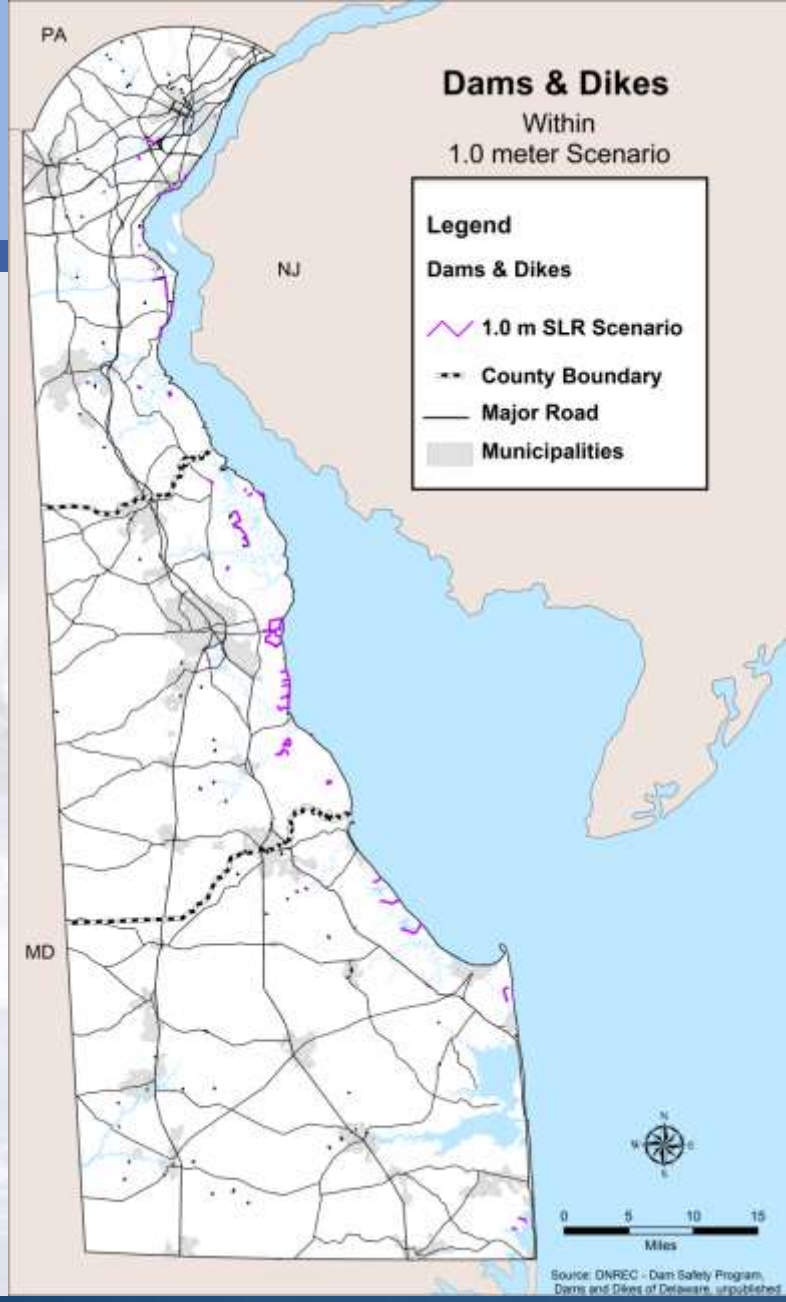
High Concern	Moderate Concern
Dams, Dikes & Levees	Septic Systems & Disposal Fields
Port of Wilmington	Landfills
Railroad Lines	Wastewater Facilities
Roads & Bridges	
Wells	
Evacuation Routes	

Public Safety & Infrastructure

Low Concern	Minimal Concern
Brownfields	Adult & Child Care Facilities
Salvage Yards	Cemeteries
Underground Storage Tanks	Schools
SIRS Contaminated Sites	Leaking Underground Storage Tanks
Underground Pipeline Utilities	DART Bus Routes & Stops
	Navigation Aids
	Public Boat Ramps & Piers
	Emergency Services

Dams & Dikes (high)

- 39% - 78% potentially inundated statewide.
- NCCo structures protect:
  - ✓ People
  - ✓ Property
  - ✓ Contaminated sites
- Kent Co. structures protect:
  - ✓ Mainly wildlife areas.

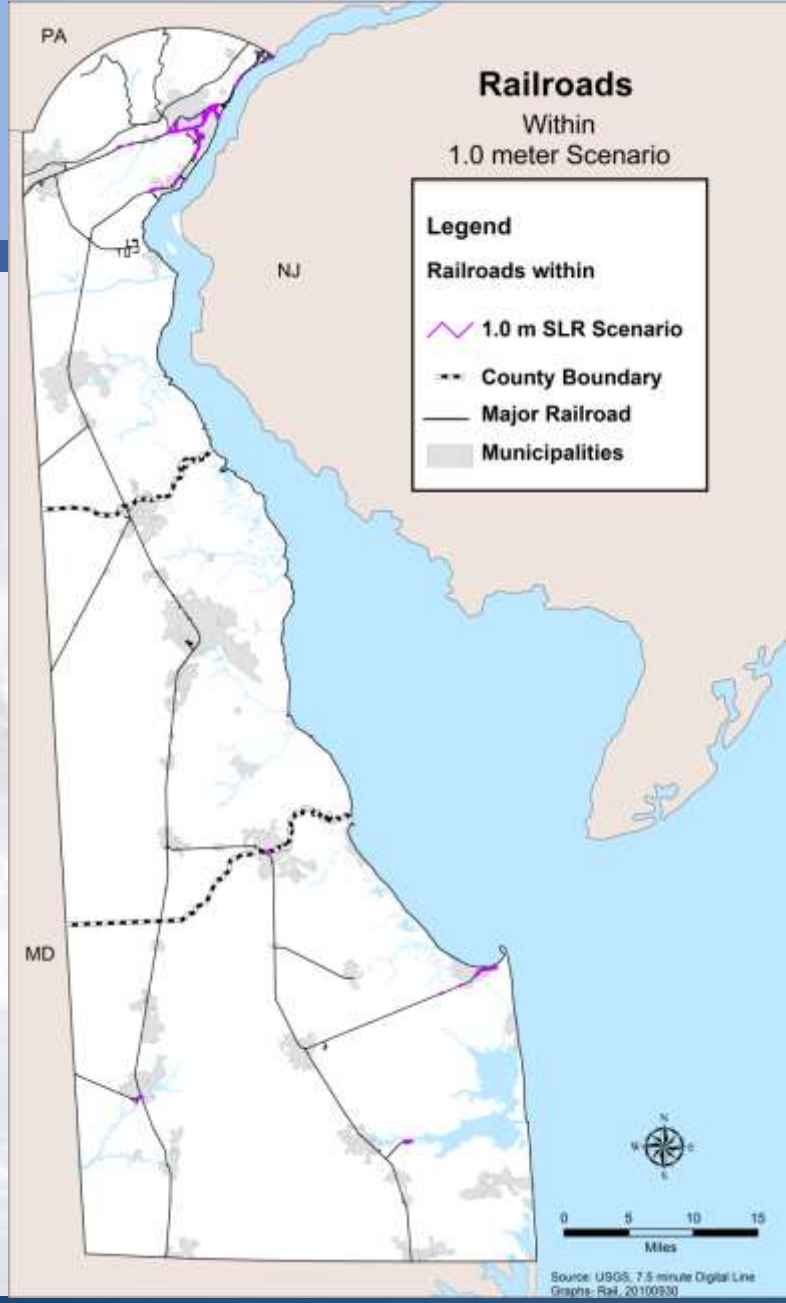


Port of Wilmington (high)

- 36% - 73% potentially inundated.
- Based in NCCo
- Nation's leading gateway for imports of:
  - ✓ Fresh fruit
  - ✓ Juice concentrate
  - ✓ One of the world's largest banana hubs
- State/regional/national economic impact

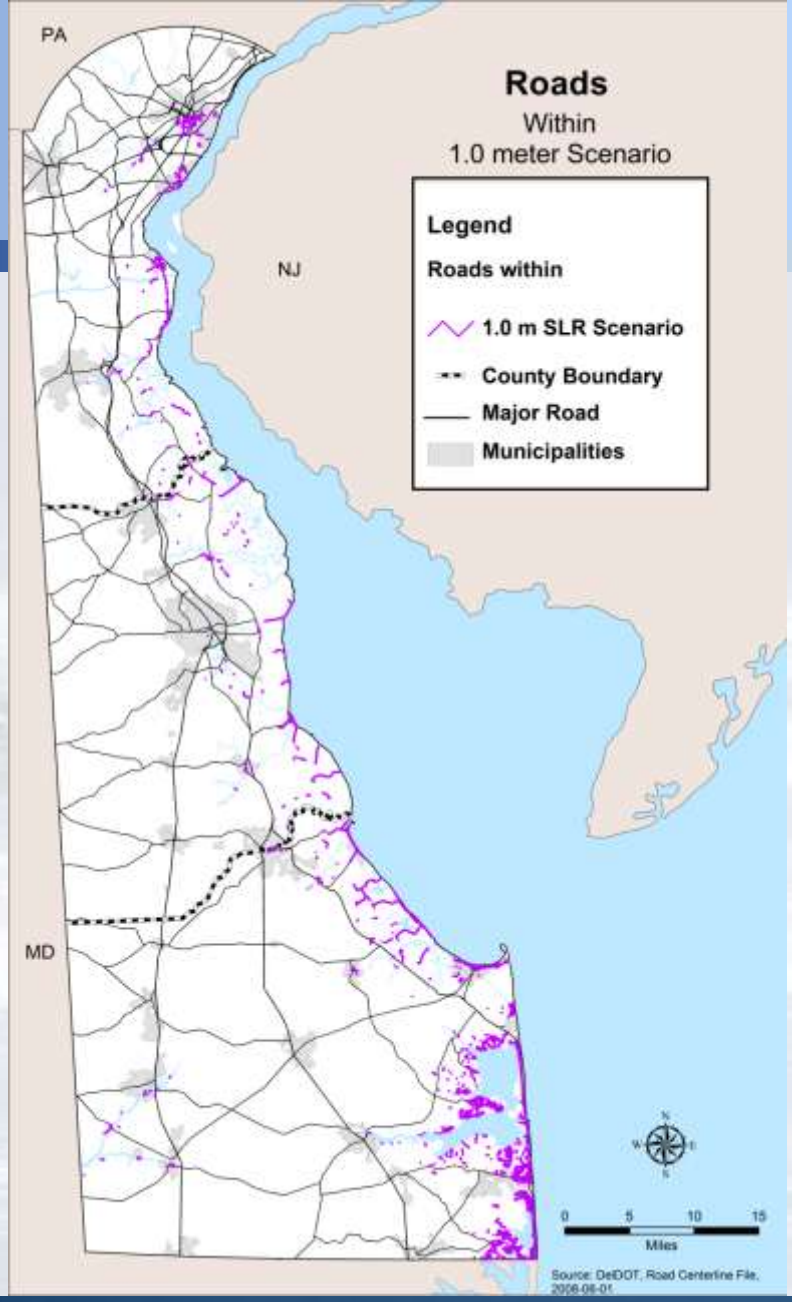
Railroad Lines (high)

- 2% - 6% potentially inundated.
  - ✓ Primarily in NCCo
- If a single segment is inundated, the entire functionality could be lost.
- Impacts
  - ✓ May cut-off industries
  - ✓ Disrupt passenger travel



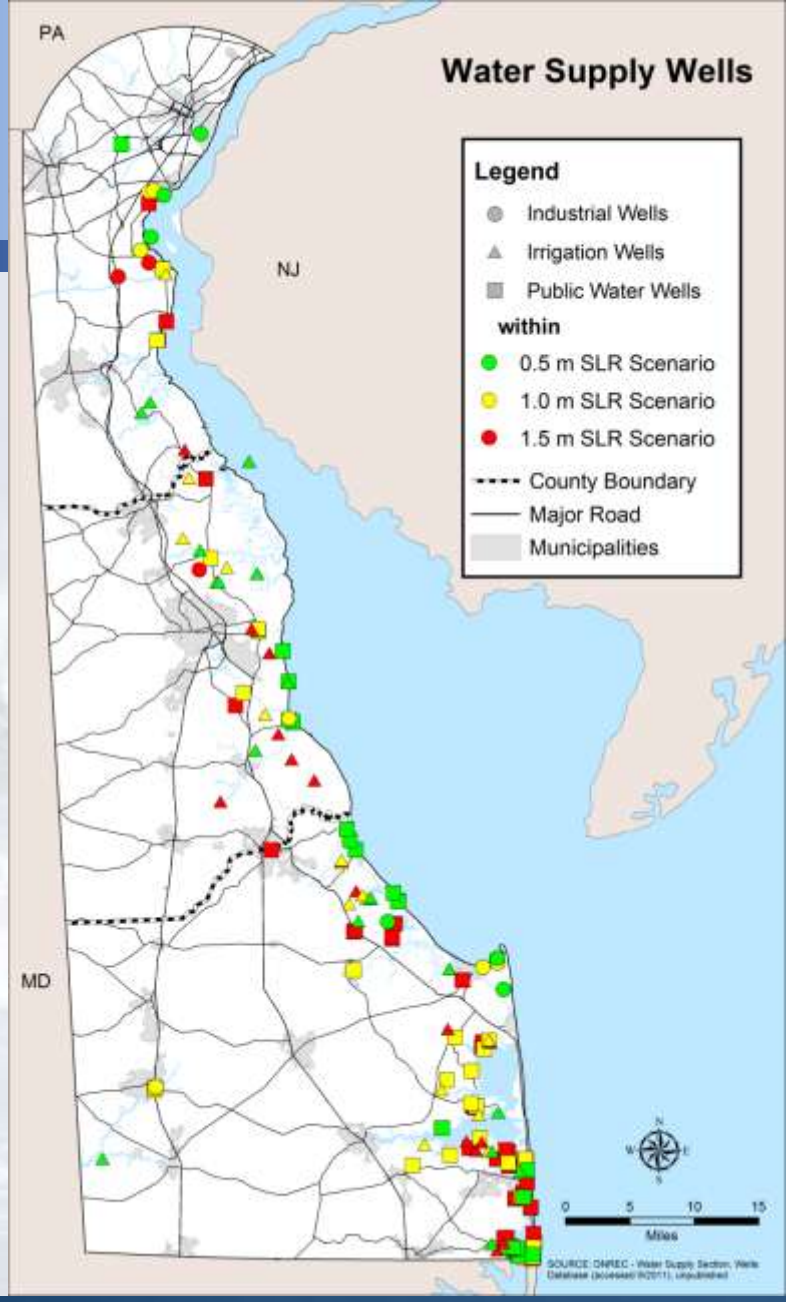
Roads & Bridges (high)

- 1% - 5% potentially inundated
- Major source of transportation in DE
- Impacts are statewide
  - ✓ Greatest concentration in Sussex
- If a single segment is inundated, the entire functionality could be lost.



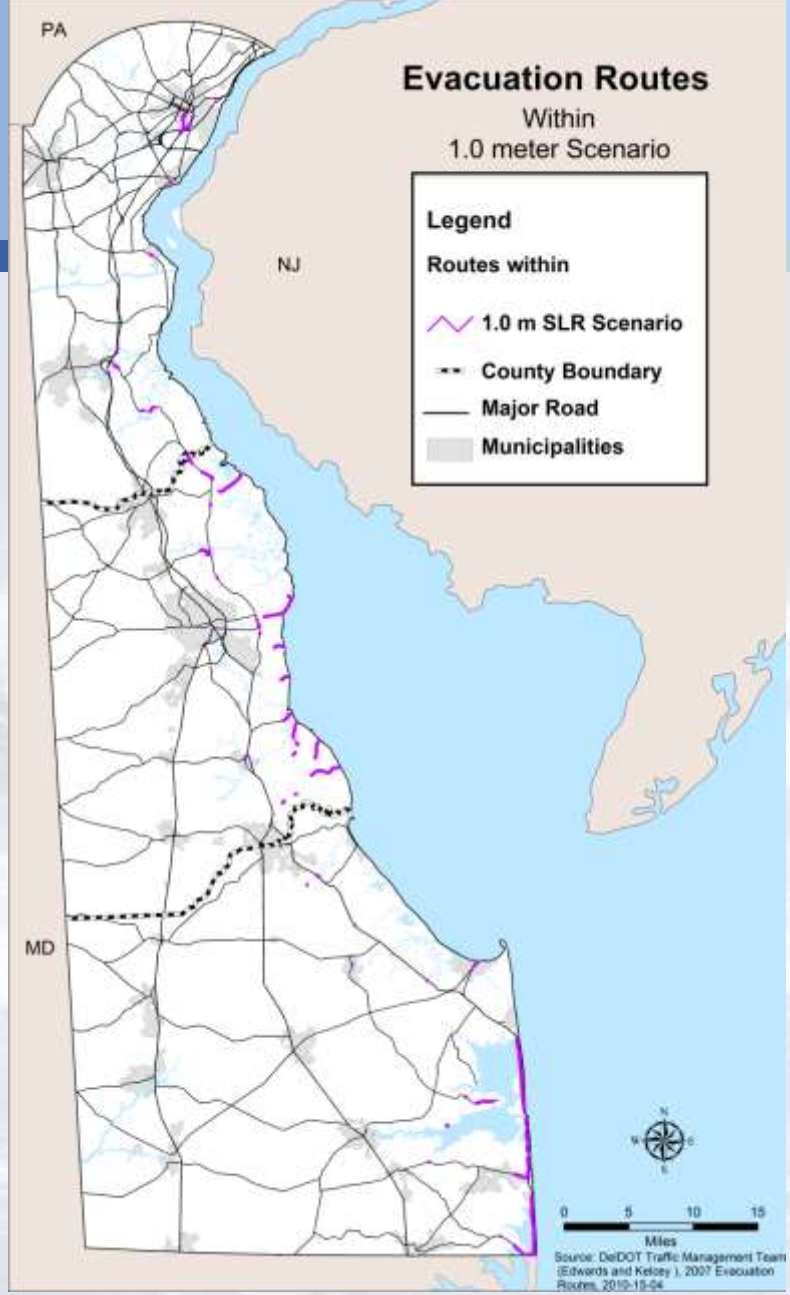
Wells (high)

- Potentially inundated
  - ✓ Domestic wells: 3% - 7%
  - ✓ Industrial wells: 3% - 7%
  - ✓ Irrigation wells: 1% - 2%
  - ✓ Public wells: 2% - 10%
- Water supply concerns
- Exposure focused along coast
- Saltwater intrusion may impact inland wells
  - ✓ Statewide concern



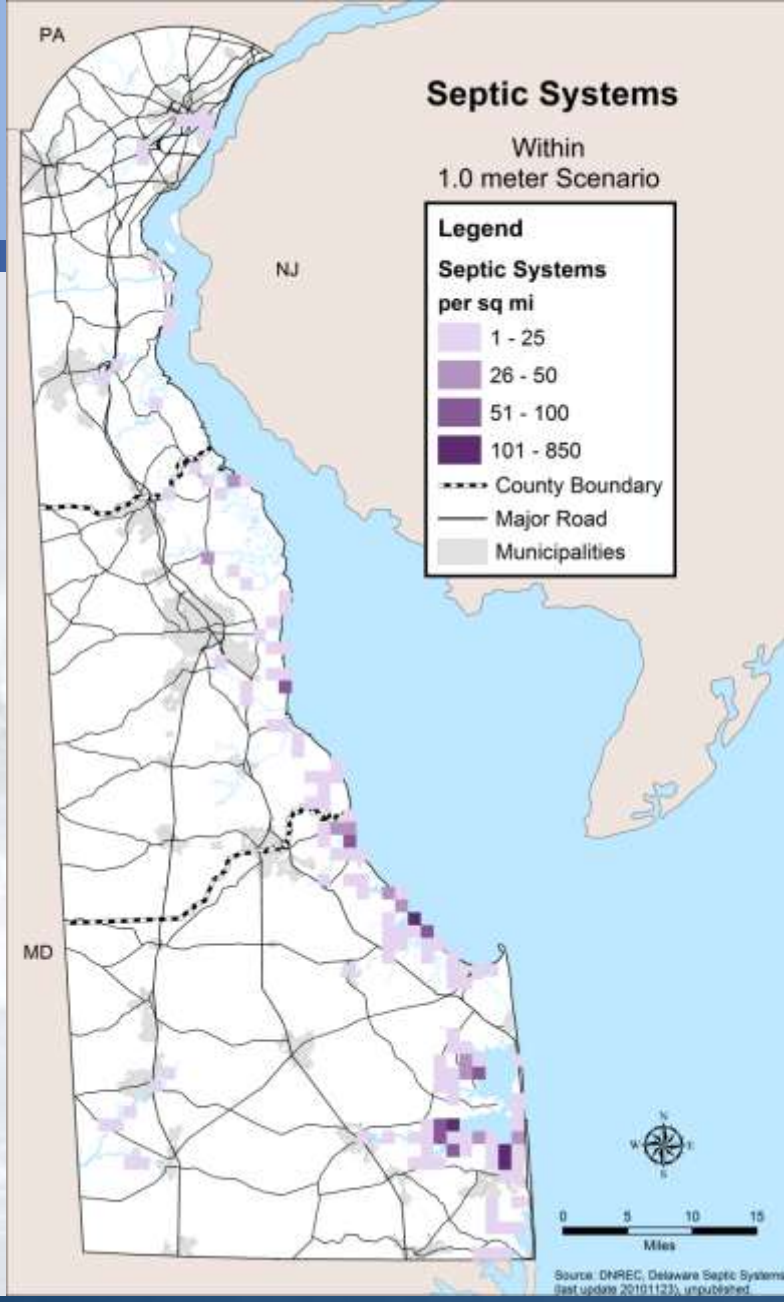
Evacuation Routes (high)

- 1% - 6% potentially inundated
- DE relies on a single mode of transportation for evacuation
  - ✓ Highways
- All 3 counties are exposed
  - ✓ Sussex has highest concentration
- Lack of access is a concern



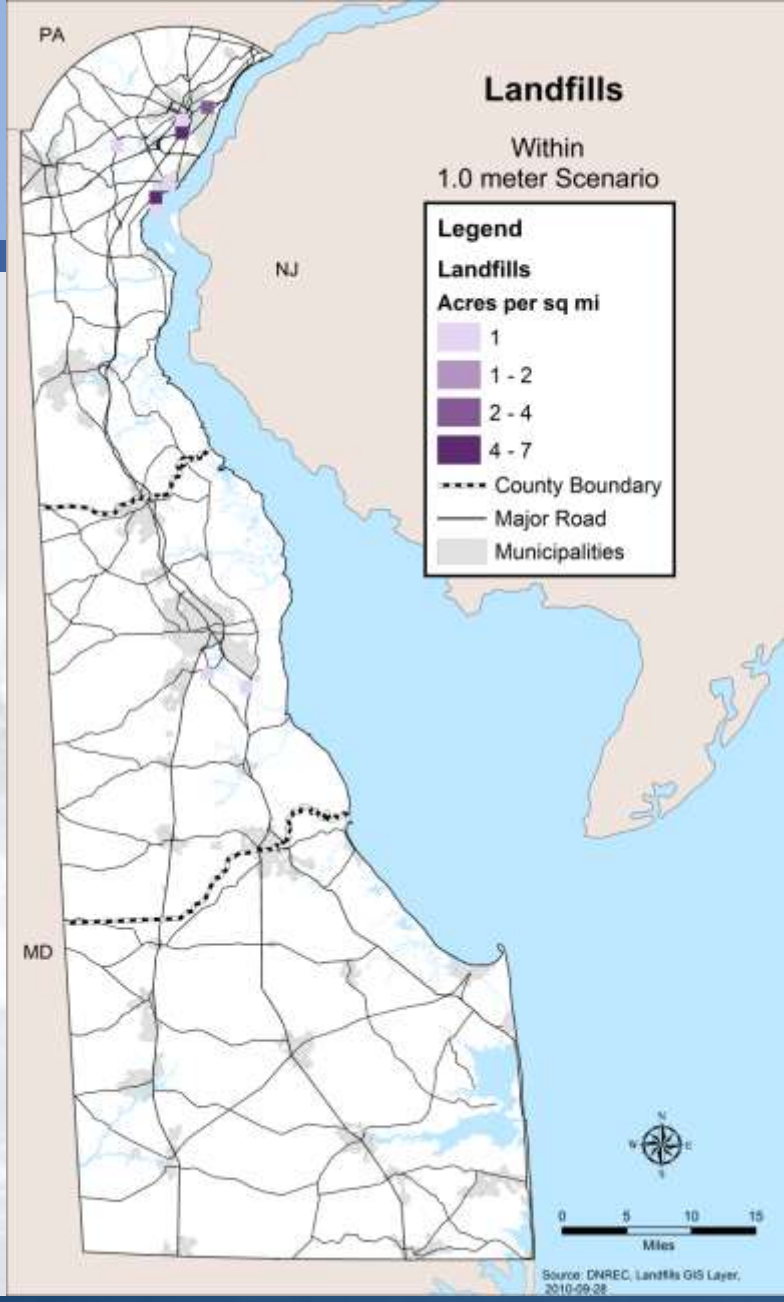
Septic Systems (moderate)

- 1% - 4% potentially inundated
- Greatest exposure found in Sussex Co.
  - ✓ High concentration along Inland Bays
- Functionality concerns before inundation
  - ✓ Rising water tables



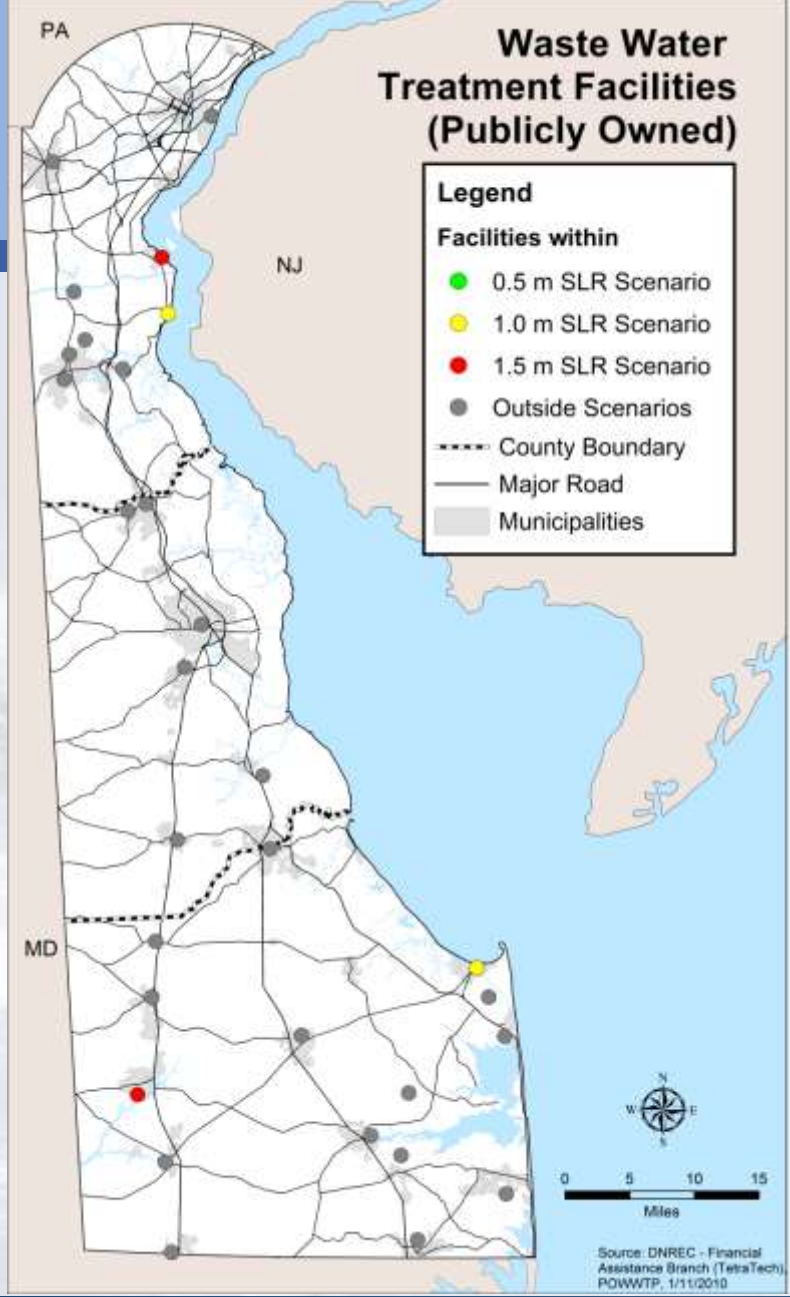
Landfills (moderate)

- 1% - 3% potentially inundated
- Includes:
  - ✓ state permitted landfills
  - ✓ Small privately owned sites
- Permitted landfills are expected to see minimal direct exposure
- Localized in NCCo
  - ✓ Sites service large area
  - ✓ Future rezoning may be an issue



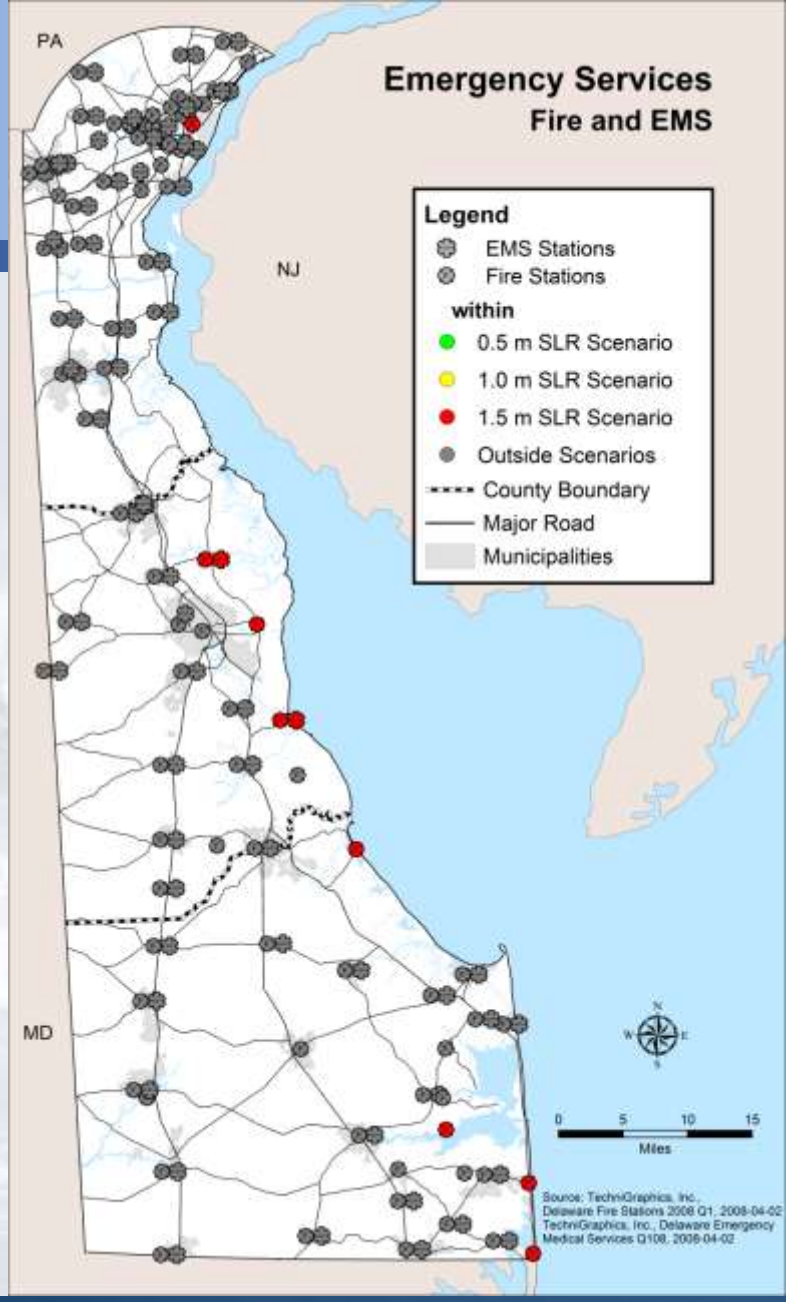
Wastewater Facilities (moderate)

- Potentially inundated
  - ✓ Sewer pumping stations: 7% - 21%
  - ✓ Spray irrigation fields: 0% - 17%
  - ✓ Treatment facilities: 0% - 13%
- All 3 counties have facilities exposed
  - ✓ The scale is localized
- Facilities service a large number of people
- Functionality concern before inundation



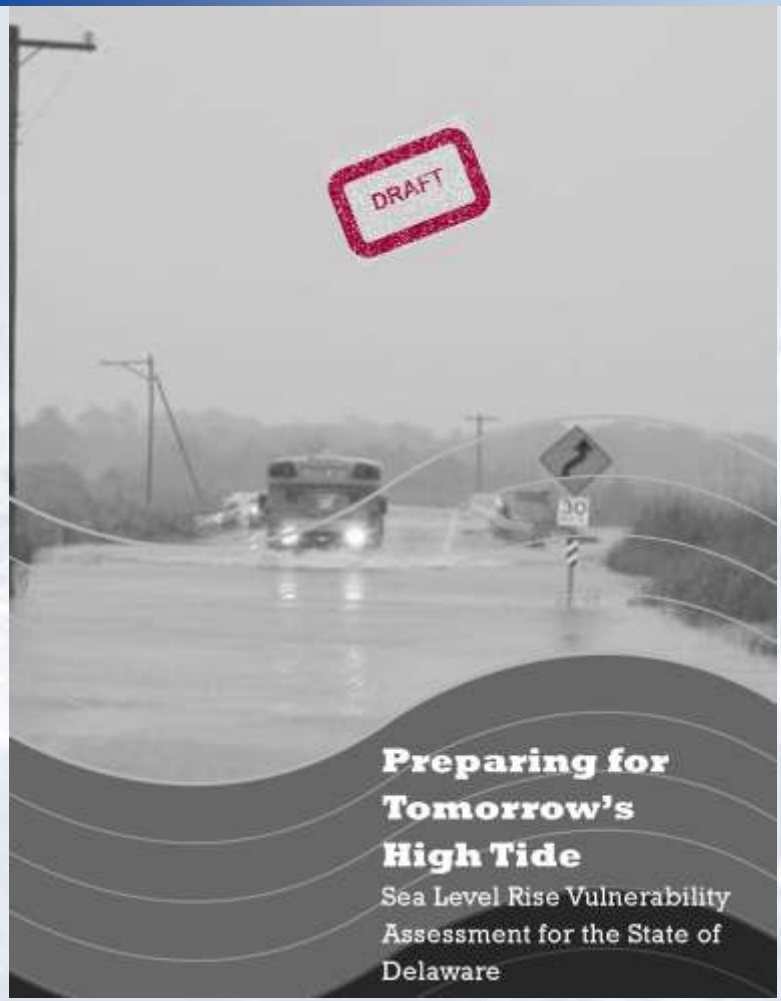
Emergency Services (minimal)

- Potentially inundated
  - ✓ Fire & rescue stations: 0% - 9%
  - ✓ EMS stations: 0% - 3%
  - ✓ Police stations: 0% - 8%
  - ✓ Operation centers: 0% - 14%
- All emergency facilities have a mutual aid backup plan
  - ✓ Secondary stations are spread throughout the state
  - ✓ Statewide backup plan will require little adaptation in the future



Next Steps

- SLRAC Review of Draft Document
  - ✓ Share with colleagues
- Submit Comments
- Final Approval @ Next Meeting
- Begin using for Adaptation Strategies
- Engagement of wider audience



Preparing for Adaptation Phase

- Background Research
  - ✓ Recommendations
  - ✓ Existing Planning, Financial and Regulatory Tools
- Vision/Goal Setting
- Workgroup meetings likely in May